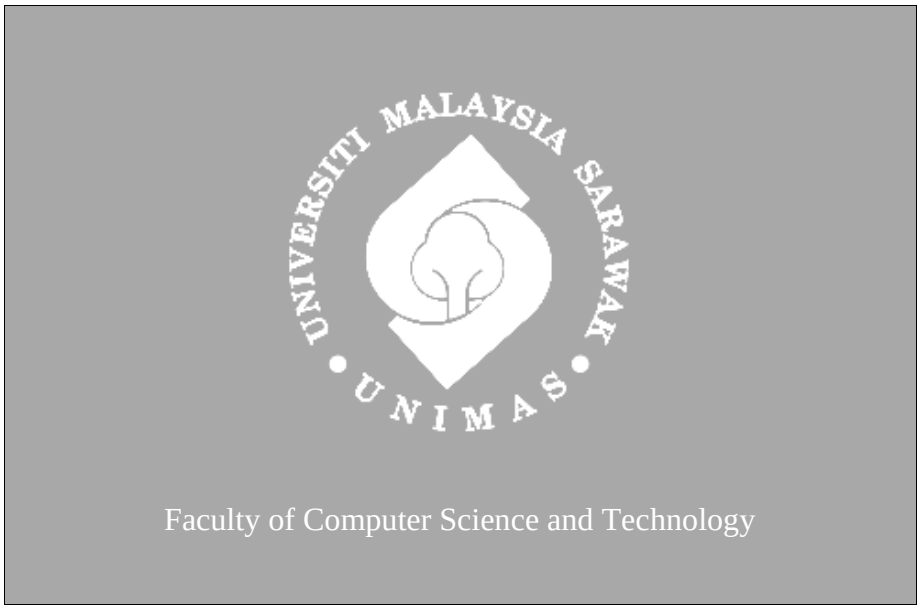

AIRXORCIST: RAISING AWARENESS ABOUT AIR POLLUTION THROUGH COMPUTER GAME

Fan Jian Wei

Bachelor of Computer Science with Honours (Multimedia Computing)
2019

AIRXORCIST: RAISING AWARENESS ABOUT AIR POLLUTION THROUGH COMPUTER GAME

FAN JIAN WEI

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Abbreviations

2D	2-Dimensional
3D	3-Dimensional
RPG	Role-playing game
NPC	Non-player character
PC	Personal computer
NES	Nintendo Entertainment System (gaming console)
PS3	PlayStation 3 (gaming console)
UI	User interface
OS	Operating system
CPU	Central Processing Unit
RAM	Random Access Memory
GPU	Graphic Processing Unit

Abstract

Air pollution is a serious problem that requires people's attention. There is a need to raise awareness about air pollution among people. In order to do so, an edutainment computer game is one plausible method. An online survey is conducted among public members to study the level of awareness on air pollution and general opinions on computer game. From the survey result, there are incorrect knowledge about air pollution detected among the participants, and some of the participants are not aware that they are directly contributing to air pollution due to the incorrect knowledges. The result also revealed that there is a demand for RPG educative games among the participants. Thus, an edutaining RPG computer game entitled "AirXorcist" is developed using Unity to help raise awareness about air pollution. A final testing, which involves a pre-game test and a post-game test, is also carried out among randomly selected public members to determine whether "AirXorcist" is able to help in raising awareness about air pollution.

Abstrak

Pencemaran udara merupakan satu masalah serius yang memerlukan perhatian. Kesedaran terhadap masalah pencemaran udara perlu ditingkatkan. Salah satu cara yang boleh digunakan untuk meningkatkan kesedaran ialah melalui permainan komputer jenis pendidikan-hiburan. Oleh itu, suatu pemeriksaan telah dijalankan secara atas talian. Daripada keputusan pemeriksaan tersebut, didapati bahawa sebilangan penyerta pemeriksaan mempunyai pengetahuan yang salah mengenai pencemaran udara, sehinggakan mereka melalukan tindakan yang menyebabkan keadaan udara lebih teruk tanpa mereka sedari. Pemeriksaan tersebut juga menunjukkan bahawa terdapat permintaan untuk RPG yang edukatif dalam kalangan penyerta. Oleh itu, "AirXorcist", suatu permainan komputer RPG jenis pendidikan-hiburan telah dicipta melalui Unity untuk meningkatkan kesedaran tentang pencemaran udara. Suatu ujian yang merangkumi ujian sebelum-main dan selepas-main juga telah dijalankan untuk menilai kemampuan "AirXorcist" dalam meningkatkan kesedaran tentang pencemaran udara.

Chapter 1: Introduction

1.1 Background

Pollution happens when pollutants or contaminants are released to the environment and cause harm to the nature. There are various type and form of pollutions, and air pollution is one of them. Air pollution occurs when harmful substances in the form of gases and particles are introduced into the environment and pollute the Earth's atmosphere. The causes of air pollution are not limited to human activity, but also natural processes. Air pollution is a very serious issue because it brings harms not only to humans, but also other living organisms such as animals and plants, holding the potential to damage both natural and built environment. According to Nel (2005), over 500,000 deaths caused by toxic particles in polluted air are estimated annually. However, Nel's prediction was wrong: air pollution is far worse and deadly than what Nel imagined. In 2015, polluted air caused about 6.4 million deaths throughout the world (Landrigan, 2017). It is not exaggerated to say that air pollution is one of the main causes of human's death.

Most of the time, air pollutants are invisible to naked eyes. The visibility of air pollution depends on the cause of the pollution, which is the air pollutant. To be more precise, there are a lot of factors that effects visibility such as air temperature, air pressure, relative humidity, average wind speed and so on (Hao et al., 2017). If the visibility in a certain area is high, this means that the concentration of air pollutants is low in the area. Even so, these gases are poisonous to human body if inhaled excessively. Thanks to school curriculums in primary school that includes some topics related to pollutions, most of the secondary school students are, at the very least, aware of air pollutions, including some main causes and effects. Using a research by Myers, Boyes and Stanisstreet back in 1999 as an example, the result from the free-

form questionnaires reflected that most of the school students were already aware of the presence of air pollutants such as carbon monoxide, carbon dioxide and chlorofluorocarbon at the age of 11-16 years old.

Haze is a phenomenon when external particles are suspended in the air, causing disturbance in human's visibility (WMO, 2017). According to Eldridge (1969), haze has the capability to be transitioned into mist and fog when there is a change in the aerosol distribution of the suspended particles in it. This is probably accurate considering that haze, mist and fog are similarly defined as air with suspended particles, and the visibility arrangement in ascending order according to WMO (2017) is fog, mist, and haze.

Asides from impairing human's vision, haze is also harmful to human body, especially if inhaled excessively. This is because the composition of haze pollution consists of a large quantity of particles that are poisonous or harmful to human's body. According to an air composition analysis, a large concentration of sulphur dioxide and nitrogen dioxide is detected in the air of Shanghai during the haze pollution in 2009 (Du et al., 2011). These gases are poisonous and harmful to human if inhaled. Additionally, it is important to take note that the analysis by Du et al. (2011) only measures water-soluble inorganic ions, which implies that there might be other pollutants that are not detected during the analysis. This further shows the dangerous of the invisible killer known as air pollution.

Computer games are usually made for entertainment purpose. For "AirXorcist", the game is considered as an edutainment game. There are various definitions for edutainment made by many researchers, but the main idea for edutainment is that it is the combination of education and entertainment (Aksakal, 2015). The game "AirXorcist" aims to raise awareness about air pollution among its players by exposing various air pollution related knowledge through

computer game elements. This is considered the education elements in this game. Whereas for the entertainment elements of this game, this game is a role-playing game (RPG). This is because an RPG provides the players with a virtual environment where the players are able to interact and engage with the environment through stories and gameplay, which is considered entertaining to many people.

At the end of this project, the expected outcome is to have a prototype of a computer game developed with the purpose of raising awareness and exposing some air pollution related knowledge to its players. The reason for "AirXorcist" to be a prototype instead of a complete game is because a test is necessary to determine whether the game will be able to achieve the main aim of the project, which is to raise awareness about air pollution through computer game, before proceeding to the production of the complete game.

1.2 Problem Statement

Air pollution is a serious issue that brings negative impacts on the nature and every living organism on Earth. Most people know about air pollution, but not all of them are aware of the impacts it brings to the environment. Thus, there is a need to raise awareness about air pollution.

In order to achieve this task, computer game is a possible way. This project intends to challenge on developing a computer role-playing game that has the ability to educate its players, or in this case, to raise awareness about air pollution among its players.

1.3 Scope

The computer game is meant for Windows Operating System (OS) only. The game is an RPG. The main theme of the game is air pollution. The target audience of the game is anyone who possess or have access to a computer or laptop. The language of the game is English only. There will be only two game stages, namely The Residential House and The Saniedion Woods, implemented due to the limited time of this project. Besides that, having only two stages means that the contents of the game are limited. This also means that the game can be cleared in a very short time. This is important because there is a very limited time for this project's development, including the final game testing which requires the players to actually clear the whole game.

1.4 Aims and Objectives

The main aim of this project is to develop a computer game that raises awareness about air pollution among its players.

a. To design a computer RPG to raise awareness about air pollution.
b. To develop a computer game with the aim of raising awareness about air pollution using Unity.
c. To investigate the effectiveness of raising awareness through computer game using pre-game and post-game test.

Commented [FJW1]: Rephrased objectives

1.6 Methodology

For this project, the agile methodology is chosen as this project's development methodology. This is because the process in agile methodology is fast and agile in development. Additionally, it is also very flexible in respond to changes in plan. Figure 1.1 shows the agile methodology cycle used. There are seven stages in the agile methodology, which are requirements gathering, analysis, design, coding, testing, delivery of partially incremented software and customer feedback (Sharma, Sarkar and Gupta, 2012).

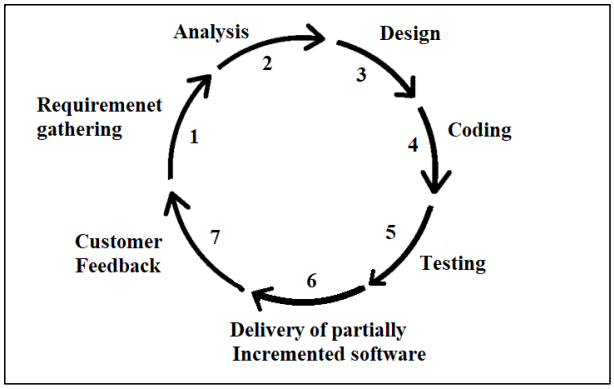

Figure 1.1. The agile methodology cycles.

i. Requirements gathering

In this stage, the requirements for the game system are gathered through literature reviews and survey.

ii. Analysis

In this stage, the requirements gathered from the requirement gathering stage are analyzed to determine the requirements to be included for the game development.

iii. Design

The next stage is to design the game. In this stage, the game design is initialized and created based on some requirements determined from the previous stages. The designs included in this stage are the game story, flowchart, UI and some monster designs.

iv. Coding

In this stage, the prototype of the game is coded and built in parts by using the relevant programming software.

v. Testing

The developed codes of the prototype built is tested to test the implemented game features and attempt to detect and fix bugs. This stage is carried out along with the coding stage.

vi. Delivery of partially incremented software (Delivery of prototype)

In this stage, the system of the software is partially incremented and is then delivered. The system is developed in increments, such that each increment is independent of others, and the developed increments will be integrated into the complete system.

For this project, this stage is replaced with delivery of game prototype, where the previously completed codes and assets are combined to produce a fully functional final prototype of the game and deliver it to the players. It is expected to take some time debugging and compiling the prototype before it is able to be delivered and tested.

vii. Customer (Player) feedback

The customer feedback, or player feedback in the case of this project, is the last stage in the Agile methodology. In this stage, a final testing will be carried out to gather comments and reviews from outsiders who are not involved in the game development. A number of random participants will be selected randomly to test play the game.

The player feedbacks are collected through pre-game test and post-game test. For both tests, various questions about air pollution will be answered by the participants. The questions in the test are designed based on the air pollution facts that are used in this game's designs. Feedbacks and comments are also gathered through verbal conservation with the participants. The results of the pre-game and post-game tests will be analyzed to determine whether this game is effective in raising awareness about air pollution among its players.

1.7 Significance of Project

This project will be able to help in raising awareness about air pollution through a role-playing computer game. This can be achieved by relating the game design with air pollution. From this game, the players will be able to learn various knowledge about air pollution. Various knowledges about air pollution are used as reference when designing the game. These knowledges are relayed to the players through in-game elements, such as the monsters' description and game stages' design.

To determine whether this game helps in raising awareness, a simple test will be carried out among the final testers of the game, before and after they played it. If this game is proven to help in raising awareness about air pollution, this signifies that computer game has the ability to relay information to its players, which in this case is about air pollution.

1.8 Project Schedule

Table 1.1 shows is the project development schedule planned based on the agile methodology stages mentioned in the methodology section.

Table 1.1. Project development schedule.

Task	Estimated duration	Start date	End date
1. Requirement gathering	21 days	20 Oct 2019	9 Nov 2019
2. Analysis	14 days	10 Nov 2019	23 Nov 2019
3. Documenting analysis results	7 days	24 Nov 2019	30 Nov 2019
4. Designing the game	24 days	1 Dec 2019	24 Dec 2019
5. Documenting the game design	7 days	25 Dec 2019	31 Dec 2019
6. Coding	5 months	1 Jan 2020	31 May 2020
7. Testing	5 months	1 Jan 2020	31 May 2020
8. Compiling the prototype	1 months	1 Jun 2020	30 Jun 2020
9. Final testing & players' feedback	7 days	1 July 2020	7 July 2020
10. Full report documentation	7 days	8 July 2020	14 July 2020

1.9 Expected Outcome

A fully functional prototype of “AirXorcist”, a computer game about air pollution, is developed. The prototype contains two game stages for the players to play. The players are able to run, jump and attack enemies. There is also a monster index to display the details of the monsters, which are designed based on air pollution related facts. The dialogs and the monster details in the monster index contains air pollution related facts, which aims to provide knowledge and raise awareness about air pollution among the players. In the final testing, the result of the test should proves that the developed prototype is effective in raising awareness about air pollution among the test participants.

1.10 Project Outline

In Chapter 1, details on the project are described briefly, including the reason the game "AirXorcist" is proposed and an introduction to air pollution. The methodology used for this project is briefly introduced and will be explained further in Chapter 3.

In Chapter 2, three existing games that are related the game "AirXorcist" are reviewed. This is the beginning of the first stage in the methodology used, specifically the requirement gathering stage. A comparison is made between the reviewed games to gather requirement on the features to be included in "AirXorcist".

In Chapter 3, the chosen methodology is further explained. The first three stages, requirement gathering, analysis and design are covered in depth throughout this chapter.

In Chapter 4, the remaining four stages are explained in detail, namely the coding, testing, delivery of game prototype and player feedback. A complete prototype is produced, delivered and tested. The results of the test are also analyzed.

In Chapter 5, the project's achievement is discussed to determine whether the objectives of the project are achieved. The objectives of the project are achieved if the computer game aimed to raise awareness about air pollution, "AirXorcist", is successfully designed, developed using Unity and is proven to raise awareness about air pollution among its players in the final testing. The future works and recommendations for the project are also discussed in this chapter.

Commented [FJW2]: The measurements for achieving the objectives